Health Management for Small Grains

Dr. Alan Dyer

Cereal Pathologist

Montana State University

adyer@montana.edu

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Promised Doug Floch: 16 Diseases

- Diagnosis
- Control*
- Future

Significant Pathogens of Cereal

Pseudomonas syringae, Xanomonas transluncens, Asters yellows agent, Biopolaris sorokiniana, Fusarium culmorum, Fuarium pseudograminearum, Fusarium graminarum, Cochlioibolus sativus, Pseudocercosporella herpotrichoides, Pythium aphanodermatum, Pythium irregulare, Rhizoctonia cerealis, Rhizocotonia solani, Microdochium nivale, Sclerotinia borealis, Typhula incarnata, Typhula ishkariensis, Sclerotium rolfsii, Gaeumannomyces graminis, Colletotricum graminicola, Ascochyta hordei, Cephalosporium gramineum, Verticillium [illegible] Heterosporium [illegible], Septoria [illegible] tonacis, Pyrenophora teres, Erysiphe graminis, Rhynchosporium secalis, Pyrenophora tritici-repentis, Stagnospora avenae, Stagnospora nodorum, Dreschlera wirrenganensis, Puccinia hordei, Puccinia coronata, Puccinia recondita, Puccinia graminis, Puccinia striiformis, Ustilago hordei, Ustilago nuda, Tilletia contr[illegible]versa, Claviceps purpurea,Penicillium claveformis, Aspergillus flavus, Barley mild mosaic, Barley mosaic, Barley stripe mosaic, Barley yellow dwarf, Barley yellow streak mosaic, Barley yellow stripe, Brome mosaic, African cereal streak, Cereal tillering, Chloris striate mosaic, Enanismo, Hordeum mosaic, Oat blue dwarf, Oat pseudorosette, Oat sterile dwarf, Rice black-streak dwarf, Rice stripe, Wheat dwarf, Soilborne wheat mosiac, Wheat streak mosiac, Austrialian wheat striate, Eastern wheat striate, Wheat yellow leaf, Russian winter mosiac, Heterodera avenae, Meloidigyne naasi, Subanguina radicicola, Merlinius brevidens, Tylenchorhynchus dubius, Practylenchus thornei,

It Could Have Been Worse!

My Expertise:

FLORAL
- Smuts and Bunts
- Scab
- Ergot
- Black Chaff

FOLIAR
- Leaf spots
- Rusts

SYSTEMIC
- Fungal
- Viral
- Bacterial

ROOT
- Seedling
- Root and Crown

Dr. Mary Burrows* New Extension Path.

Emailed:

- **Dirty Little Diagnostic Cheat Sheet**
  (Warning! Environmental, Nutrients…)

- **New Seed Treatment MontGuide**

Will be available at:

http://plantsciences.montana.edu/department/plp/pathology.html

FLORAL

FOLIAR

SYSTEMIC

ROOT

DIAGNOSIS:

What plant part is affected?

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My Wheat Heads Have Turned Prematurely White?

FOLLOW UP QUESTION

Are the heads completely affected or are portions of heads affected?

DIAGNOSIS:

FLORAL

FOLIAR

SYSTEMIC

ROOT

Sometimes entire heads. Sometimes portions of heads

Heads are completely affected…

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Floral Diseases

- Diseases where floret become prematurely bleached (Scab, Black Chaff, Septoria Glume Blotch)
- Diseases where the florets remain green (Smuts, Bunts and Ergot)

Grower: Inconsistent… Sometimes entire heads. Sometimes portions of heads

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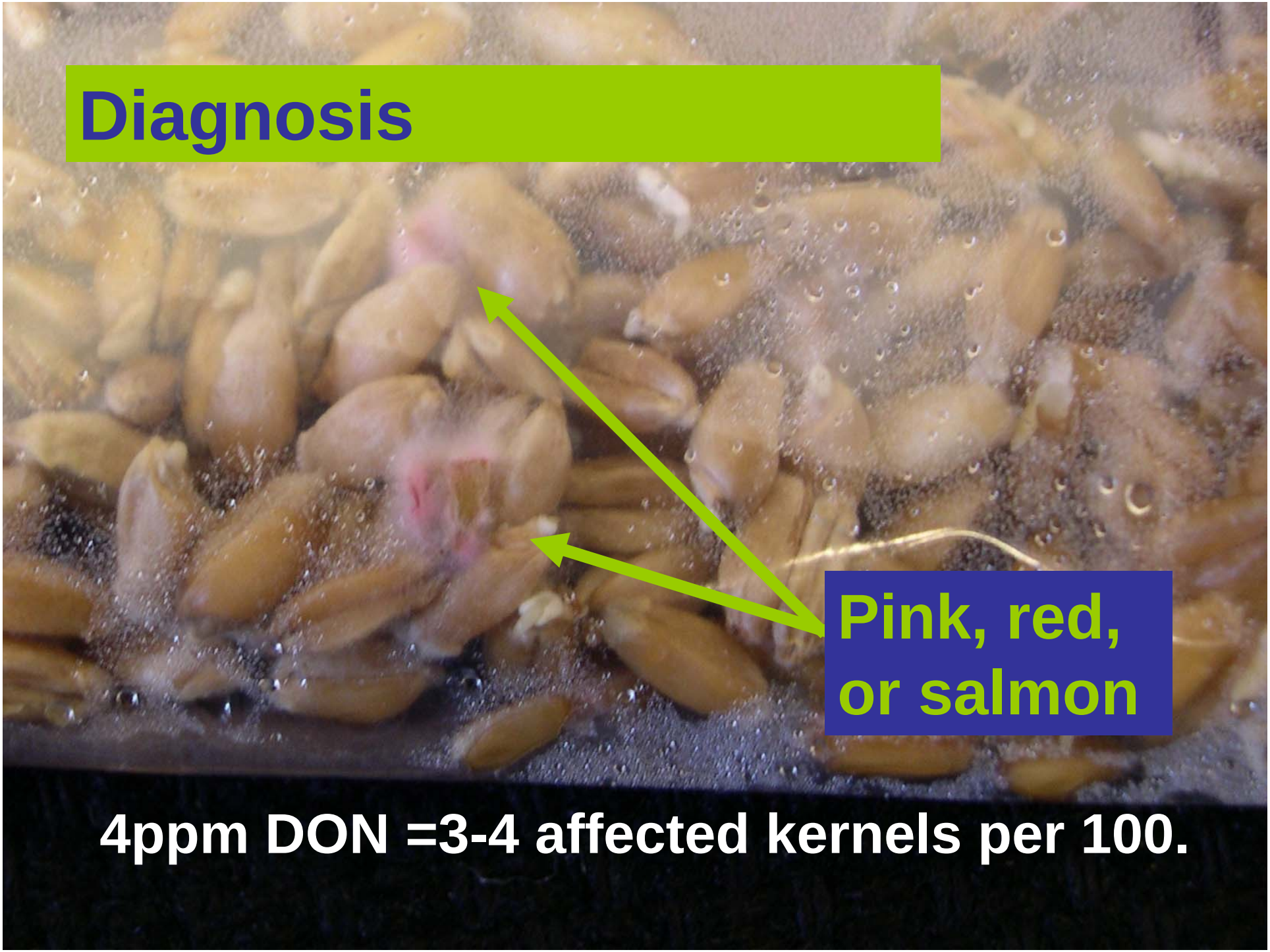
Scab, Black Chaff, and Glume Blotch

- **Look for black discoloration**
  - **(black chaff or glume blotch)**
- **Pink Discoloration (Scab)**

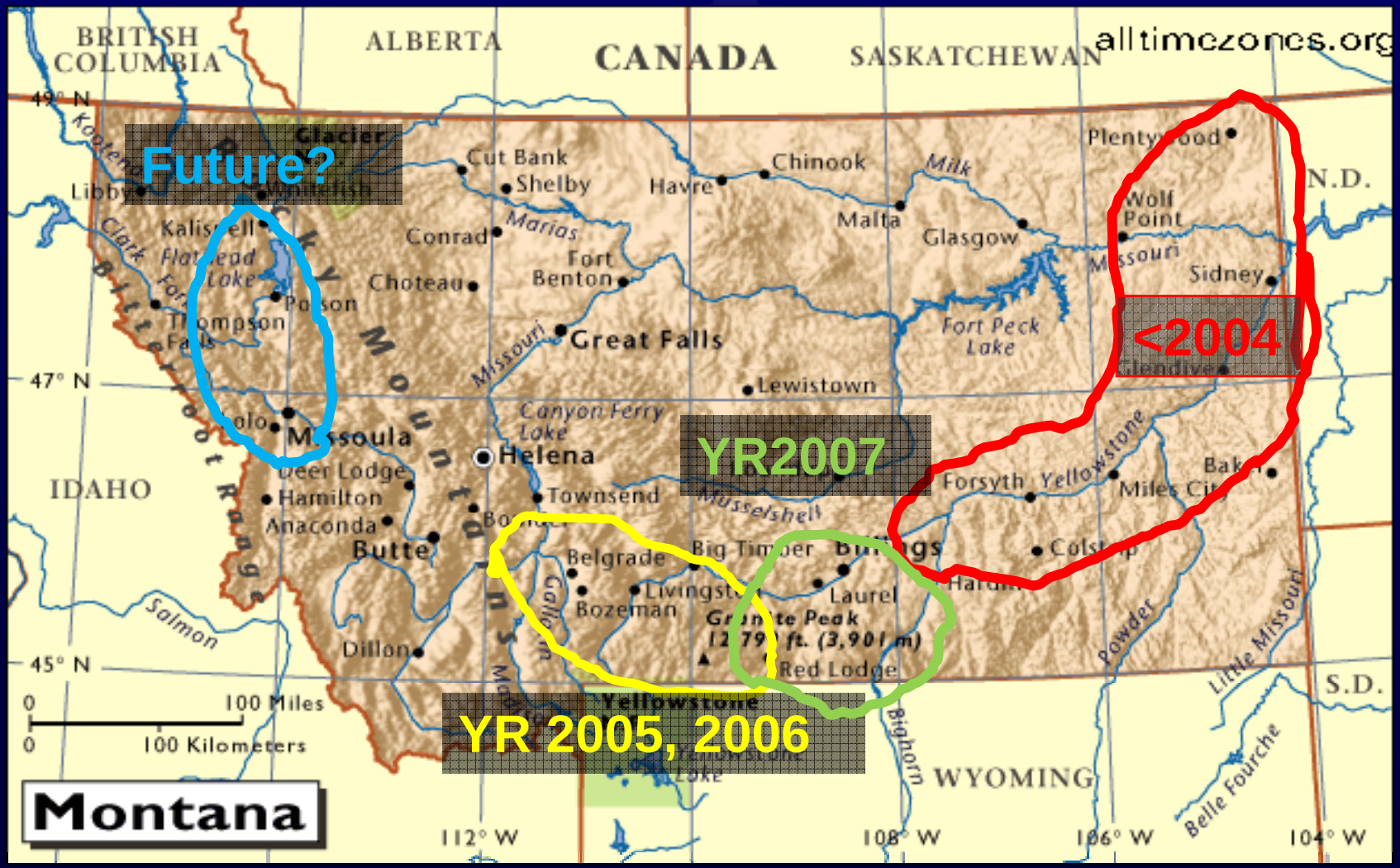
Post Harvest?

Diagnosis



4ppm DON =3-4 affected kernels per 100.

Scab in Montana



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Map http://www.peninsulaflyfishers.org/Fishing_Tales/montanaSpring02/montana_map.gif

Montana's Scab Control?

- **Sumai 3 Resistance**
- **Folicur or Proline**

2006 Irrigated Scab Nursery

Cultivars	DON	Lodging	Ergot	Yield
HANK	10.08	0	0	53
EXPLORER	1.99	0	0	61
ESPRESSO	1.98	1	0	76
GLENN	0	37	0.01	67.3
ALSEN	0	31	0.14	67.7
GRANITE	0.11	64	0.07	74.5
KELBY	0.25	0	0	78.5
KNUDSON	0.15	49	0.02	80.7
FREYR	0.06	63	0.03	85
ACS52610	0	78	0.02	86.7
VOLT	0	8	0.01	90.5

Red indicates deficiency

Predictions:

- Scab will spread into Idaho, Oregon, Washington and Wyoming (390,000 irrigated acres)
- Ergot (and black chaff) epidemics will occur in scab resistant lines.

Ergot Control:

- Rotation (1 year out of cereals)
- Deep Plowing
- Clean Seed

- Mow headlands before they set seed

Ergot in headlands

What About Black Chaff?

DIAGNOSIS:

FLORAL

FOLIAR

SYSTEMIC

ROOT

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Foliar

- Large necrotic spots with halos(Leaf spots: Tan Spot, Septoria Leaf Spot, Chloride Deficiency)
- Copious spores production with little necrosis (Rusts and Mildews)

DIAGNOSIS:

FLORAL

FOLIAR

SYSTEMIC

ROOT

I have orange spots on my leaves.

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Diagnosing Rusts

Rust	Color	Temperatures	Size
Stripe Rust (*P. striiformis*)	Bright Orange	Cool (< 80's)	Large Diffuse
Leaf Rust (*P. recondita*)	Brick red	Moderate (mid 80's)	Small Discrete
Stem Rust (*P. graminis*)	Burnt Red	High (Mid 80's-90's)	Large, Heavy And Often On Stems

Montana

- Stripe Rust (2005-present)
- Leaf Rust (2007)

Stripe Rust Control Is Dynamic

- **Currently Most Resistant Winter Wheat for Montana: “Yellowstone”**
- **Fungicides: Most labeled fungicides work well. I use Quadris or Quilt.**

Fungicides increase yield and test weight under stripe rust pressure (Bozeman, 2006)

		Yield (bu/a)			Test weight	
	Resistance reaction	No fungicide	Quadris (14 oz/a)	% loss	No fungicide	Quadris (14 oz/a)
NuWest	VS	69	107	34	58	61
BigSky parent	S	73	89	18	58	61
Rampart parent	R	85	90	6	60	60
McNeal	S	73	80	9	56	56

Grey, 2006

Stripe rust evaluations: winter wheat

Bozeman, 2006

Variety	Yield (Bu/a)	% Stripe rust (June 28)
Yellowstone	99	7
Promontory(?)	93	9
Jerry	89	10
NuFrontier	85	10
Rampart	80	18
Pryor	80	42
Jagalene*	79	12
CDC Falcon	78	55
Genou	71	36
Ledger	70	41
Neeley	70	72
NuSky	66	82
NuWest	65	83

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Grey, 2006

Changing Picture?

- **MT now has rust isolate “PST-102”: Virulent on Yr9 and Yr10, the R genes in Promontory.**

Predictions:

- Stripe rust and leaf rust will continue to be a problem
- Resistance to stem rust isolate Uganda99 will be incorporated into US Wheat and will only be a blip in US wheat production

FLORAL

FOLIAR

SYSTEMIC

ROOT

DIAGNOSIS:

Systemic diseases are a little challenging

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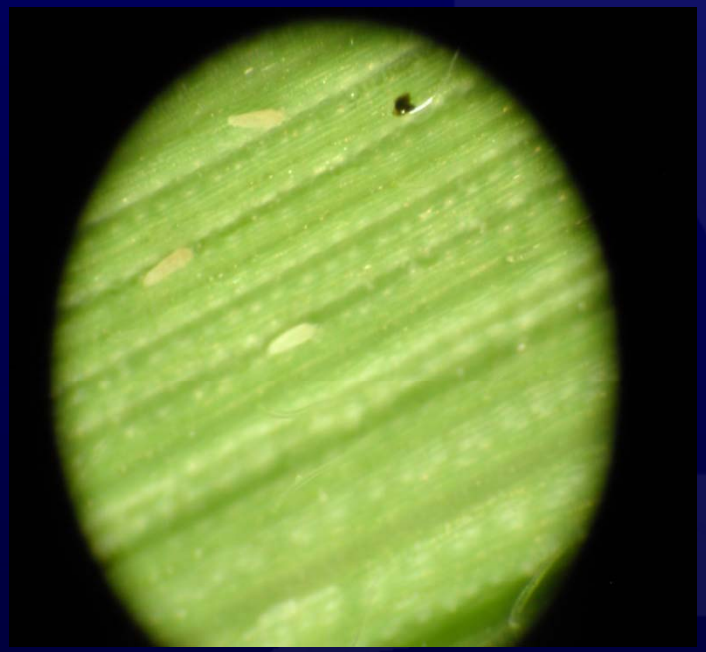
Systemic Diseases (Confusing)

http://www.gov.on.ca/OMAFRA/english/crops/field/news/croppest/2003/08cpc03a1f1.jpg

- Cephalosporium Stripe
- Viruses (Wheat Streak)
- Phytoplasmas?

(Nutrient/Environmental?)

Wheat Streak Mosaic Virus



- **Transmitted by: wheat curl mite**
- **Control:**

  remove green bridge

Cephalosporium Stripe

- Rotate to spring crops for 2 years
- Use tolerant cultivars
- Future resistance?

Break and Questions:

FLORAL

FOLIAR

15 Minutes

http://plantsciences.montana.edu/department/plp/pathology.html

ROOT

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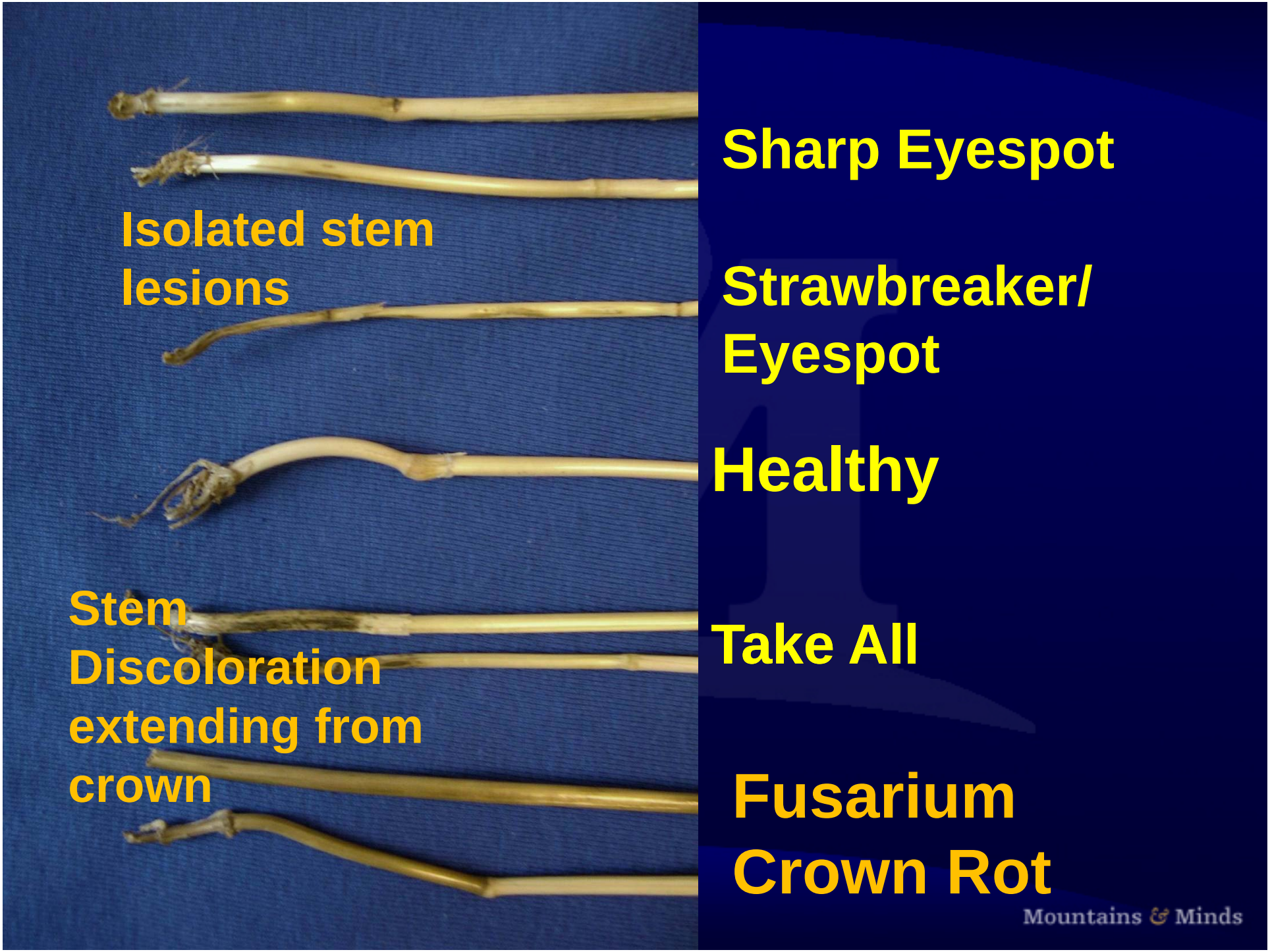
Root, Crown, and Seedling Diseases

Many of the same pathogens

Crown diseases are easiest

Scout within 3 weeks of harvest

(New Seed Treatment MontGuide)


Isolated stem lesions
Stem Discoloration extending from crown
Sharp Eyespot
Strawbreaker/ Eyespot
Healthy
Take All
Fusarium Crown Rot
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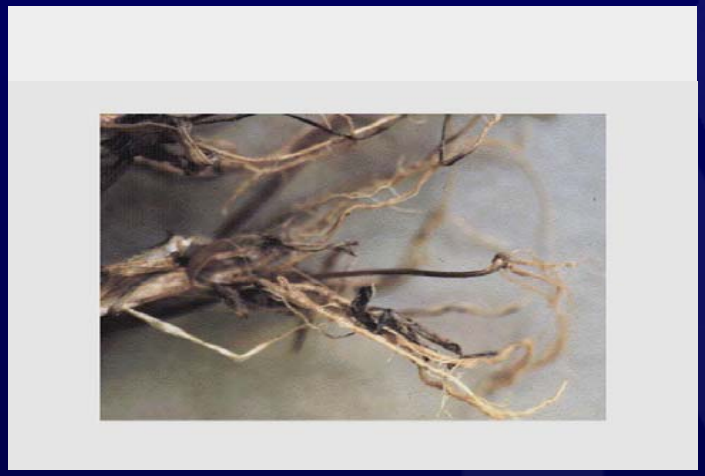
Common Root Rot



- Seed treatment
- Reduce planting depth

Paired Plot Analysis of Fusarium Impacts On Winter Wheat (2006)

Cultivar	Yield Loss
BigSky	0
Hatcher	20
Jagalene	15
Ledger	10
Pryor	16
Yellowstone	14

-Ave. 12.5

Fusarium Impacts on Spring Wheat

Huntley, MT 2005

Explorer	9.4
McNeal	10.3
Alsen	11.5
Hank*	11.7
Outlook	13.2
Knudson	20.8
NorPro	21.0
Reeder	21.8
Choteau	22.0
Vida	22.5

-Ave. 16.4%

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*Reduction likely higher than reported

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Fusarium Impacts on Durum and Spring Wheat

Huntley, MT 2005

Utopia	12.3
Kyle	15.2
Monroe	16.7
Mountrail	17.1
Vic	20.2
Lebsock	22.7
AC Avonlea	23.5
Ben	23.6
Ward	24.4
Maier	25.1

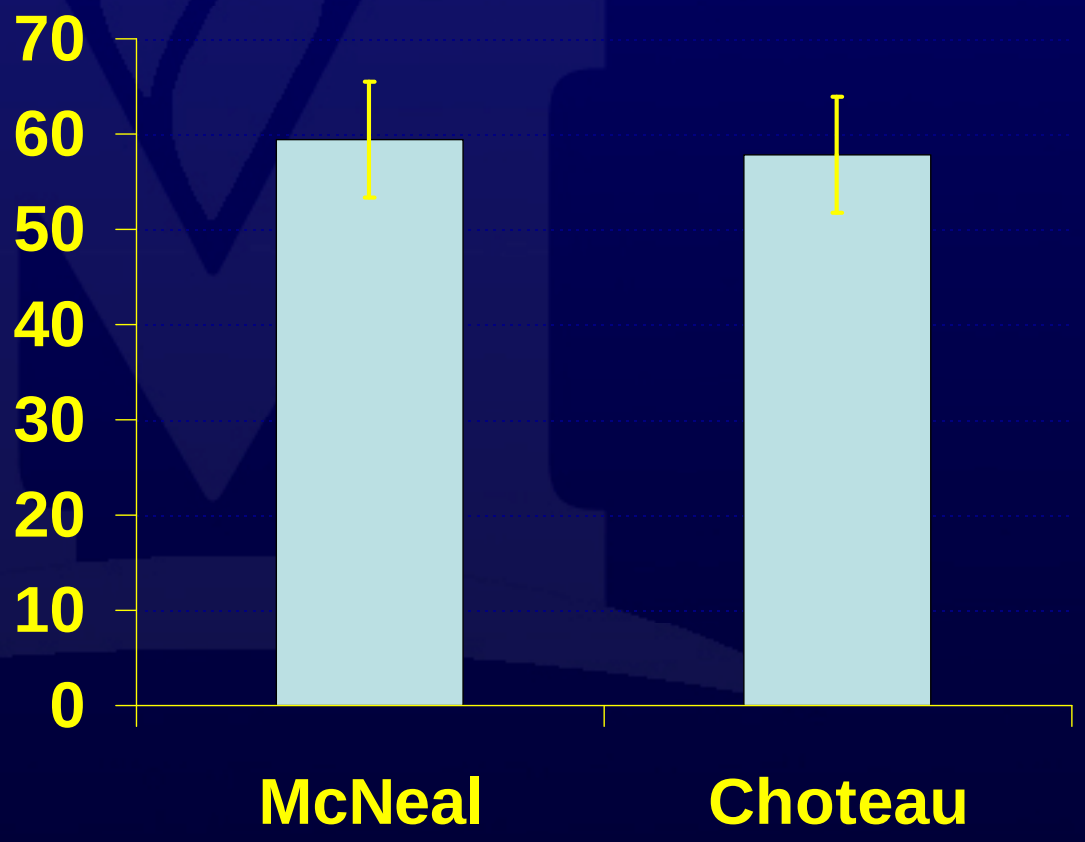
-Ave. 20.1

Cultural Practices to Control Fusarium Crown Rot

- Choteau, McNeal
- Fertility: 100, 75, and 50% of recommended nitrogen –based on current & estimated water availability
- Stand Density: 20, 15 and 10 seed/ft^2
- Inoculated: *F. pseudograminearum*

Yield: Year 1

No Significant Differences



Disease: Year 1

Significant Differences

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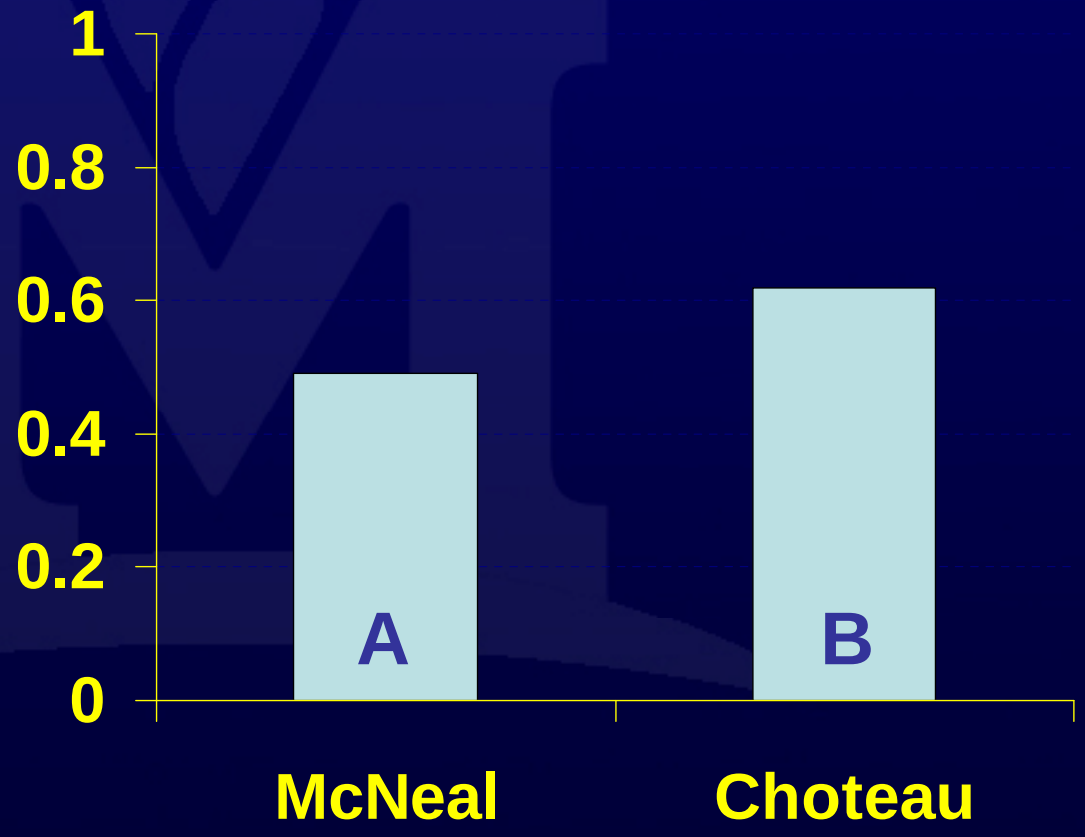
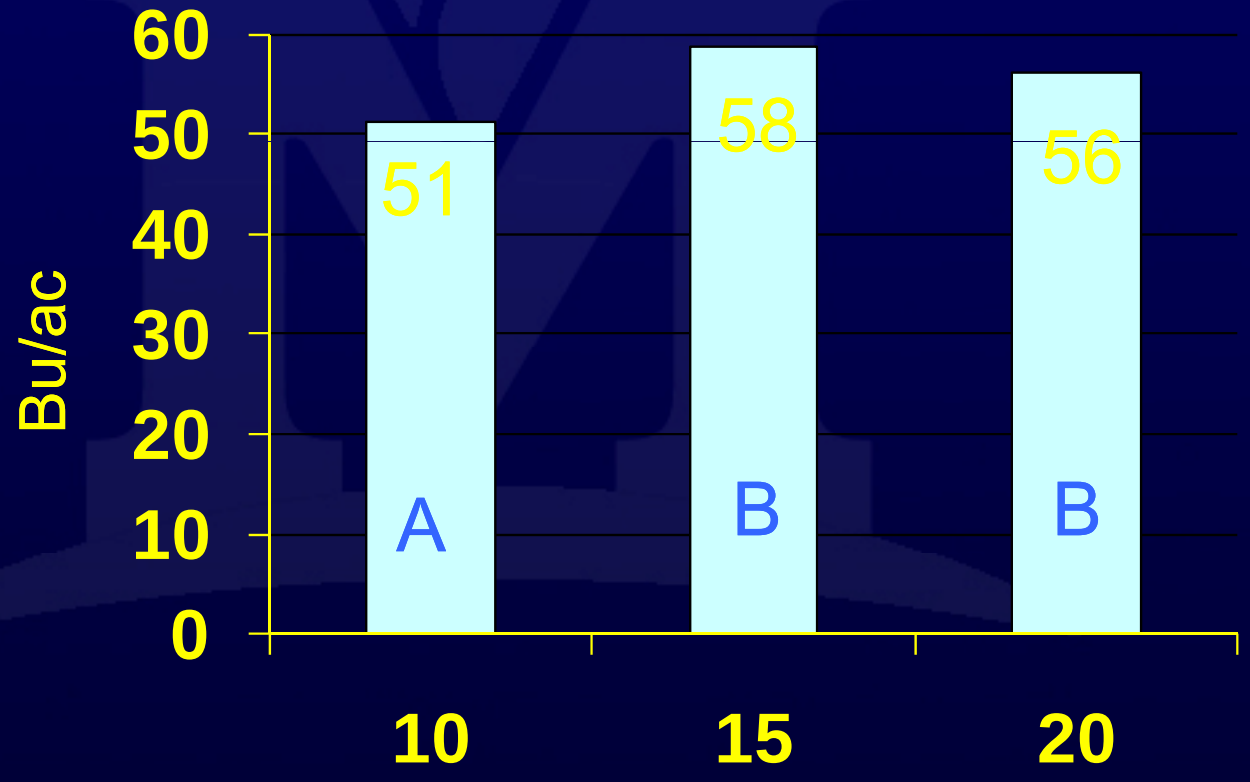


Seeding Densities Without Fusarium (excess N)

Lower Seeding Density Cost



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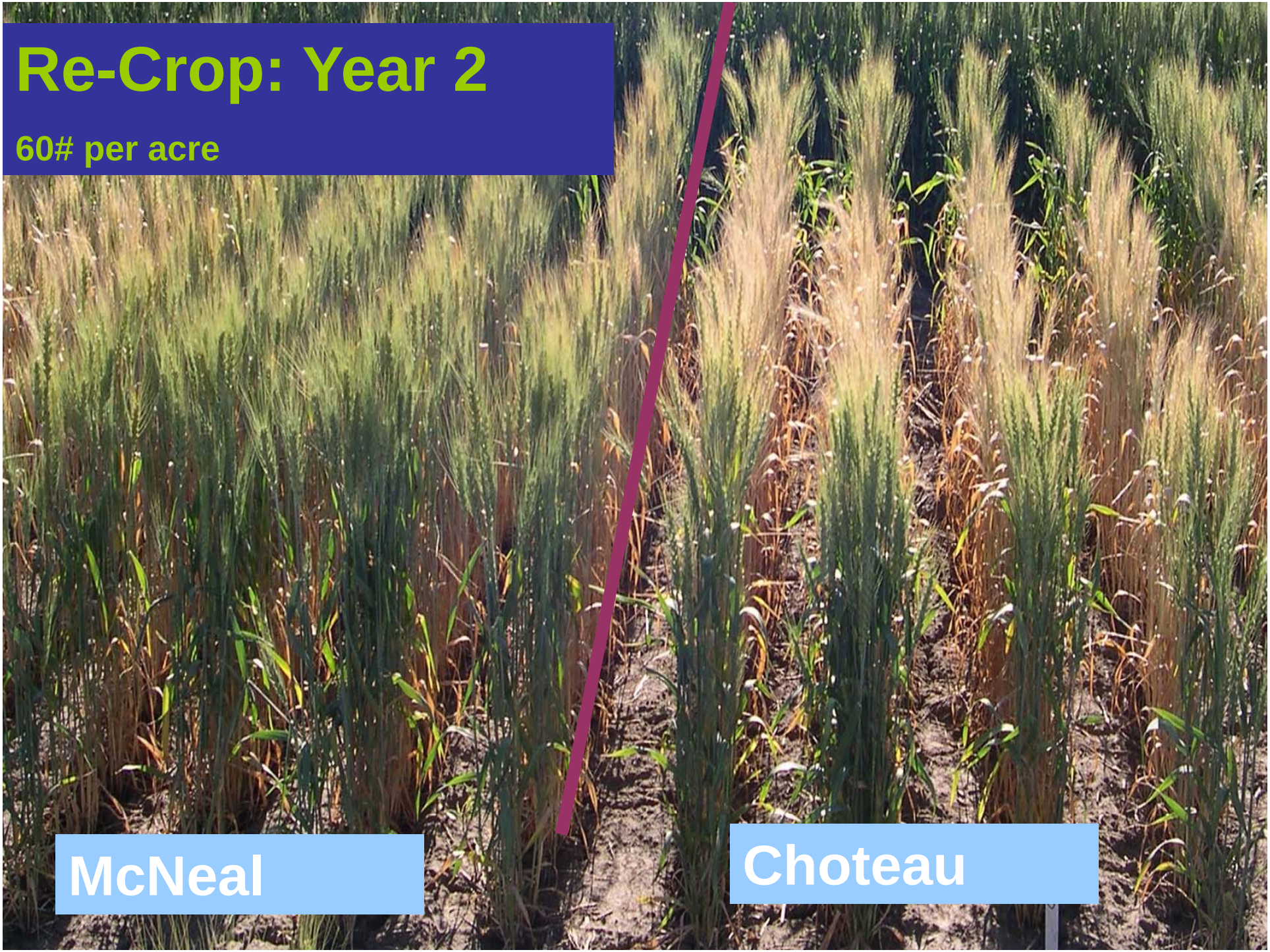
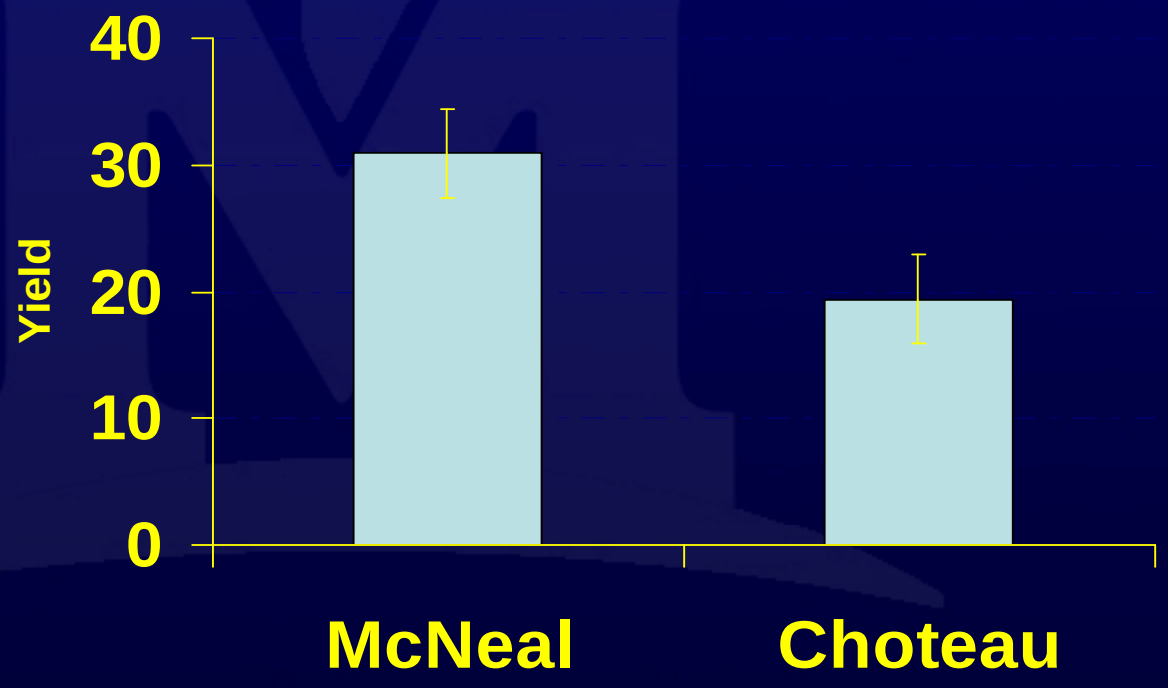

Re-Crop: Year 2
60# per acre
McNeal
Choteau

Yield for Year 2

P<0.001



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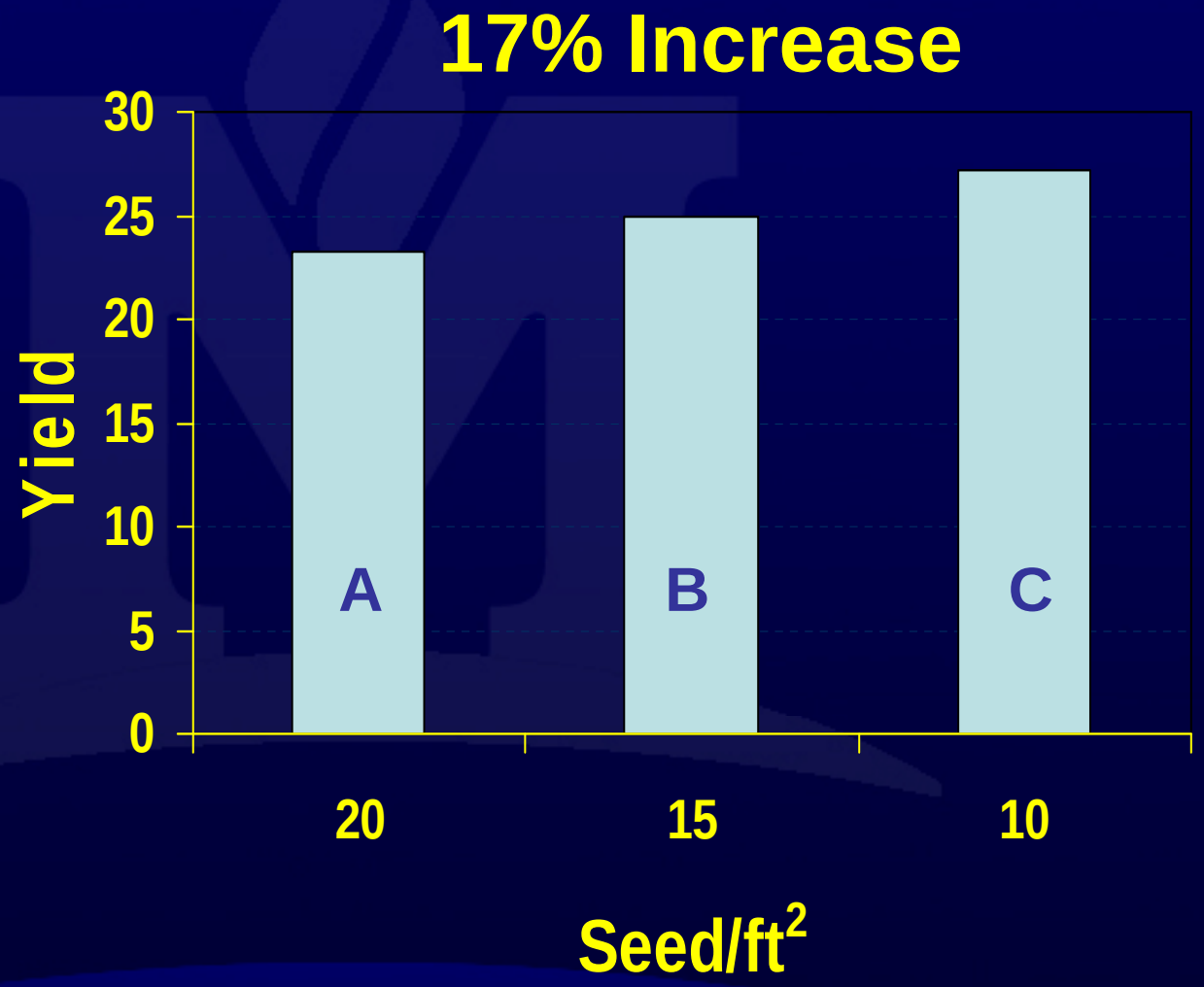
Yield - Year 2: Stand Density

McNeal
8%

Choteau
32%

P<0.001



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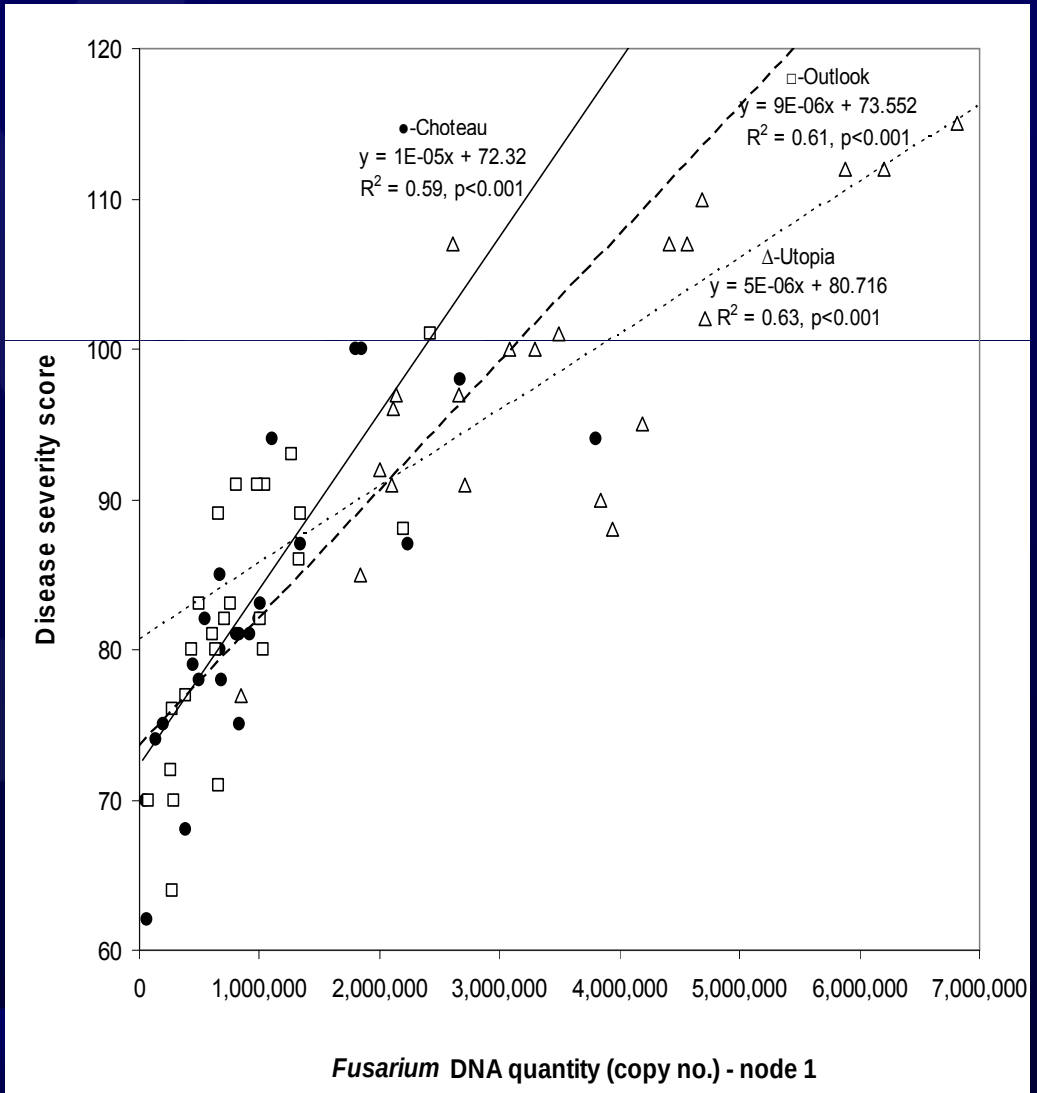
Fusarium Crown Rot Recommendations

- All Crops: Seed Treatment (especially for winter wheat)
- For Annually Cropped Spring Wheat: Reduce Seeding Density

Future ?

Mismanagement of FCR can result in a 40% difference between expected and actual yield.



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Seedling Diseases

Diagnosis is heavily oriented to the field history

Seed treatments are the main source of control

Most Common Sources of Problems (Winter Wheat)

Situation A:

Planting into dry seed bed:

Dry Seed Decay

Situation B:

Winter-kill despite good snow cover:

Fusarium Seedling Blight or Snow mold

Fusarium Induced Winterkill

Entry	Percent Stand
BigSky	75.0
Hatcher	81.3
Jagalene	80.0
Ledger	77.5
MT01148	66.3
MT02113	91.3
MT03176	66.3
MTW01133	58.5
Pryor	76.3
Yellowstone	70.0

-Ave. 74%

Spring and Durum Wheat

Situations A:

Cold wet spring or irrigated production

Durum Wheat

Pythium

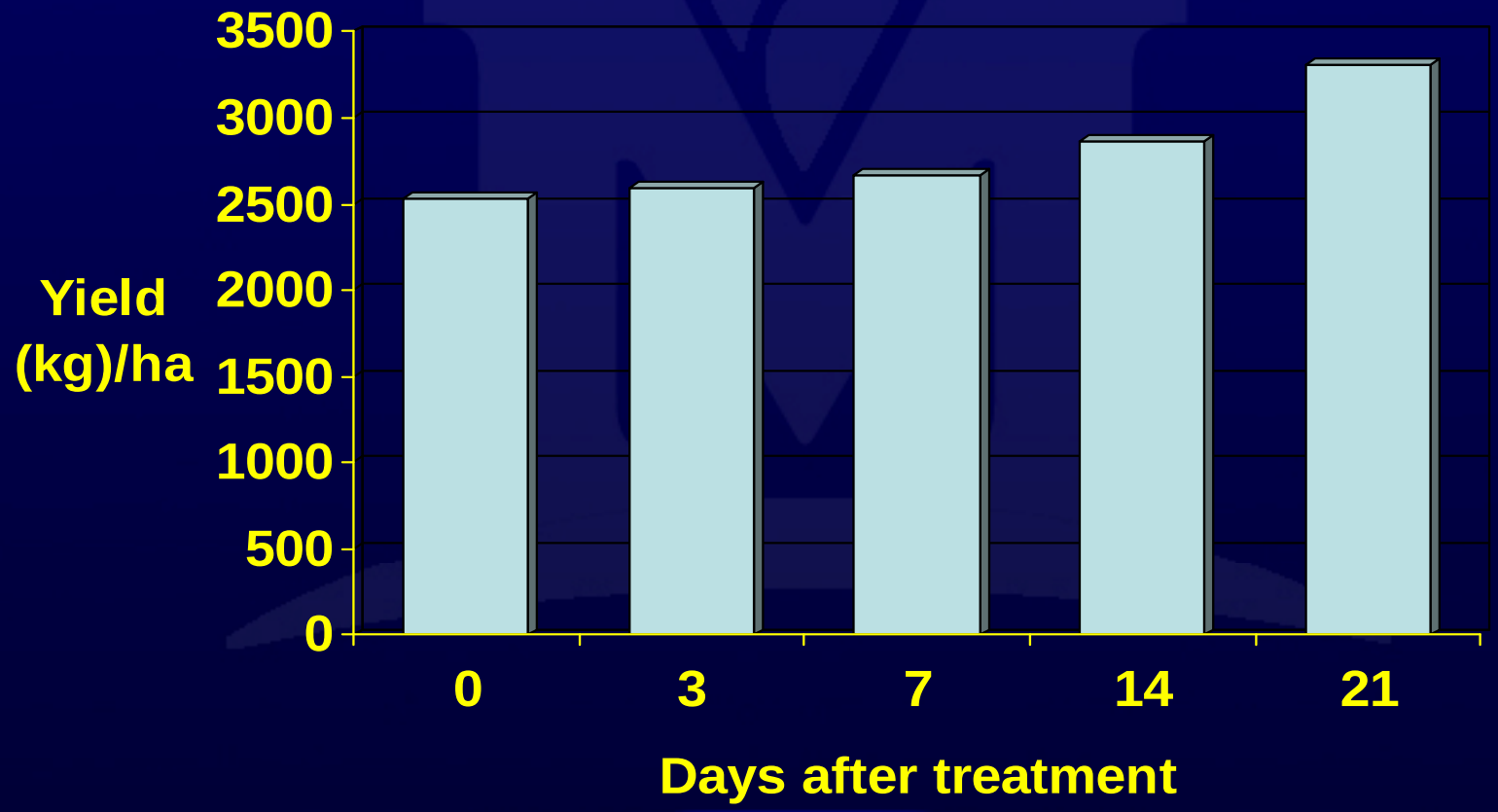
Situation B:

Planting quickly after glyphosate treatment

Rhizoctonia Bare Patch

Rhizoctonia Bare Patch

Effects of Planting Relative to Glyphosate Treatment



Smiley et al. 1992

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Rhizoctonia Bare Patch Control

- Wait three weeks after glyphosate treatment
- Treat seed with Charter, Raxil, Dividend or another effective seed treatment
- Disking field before planting…. Why?

Root Diseases: TOL

Very few diagnostic symptoms

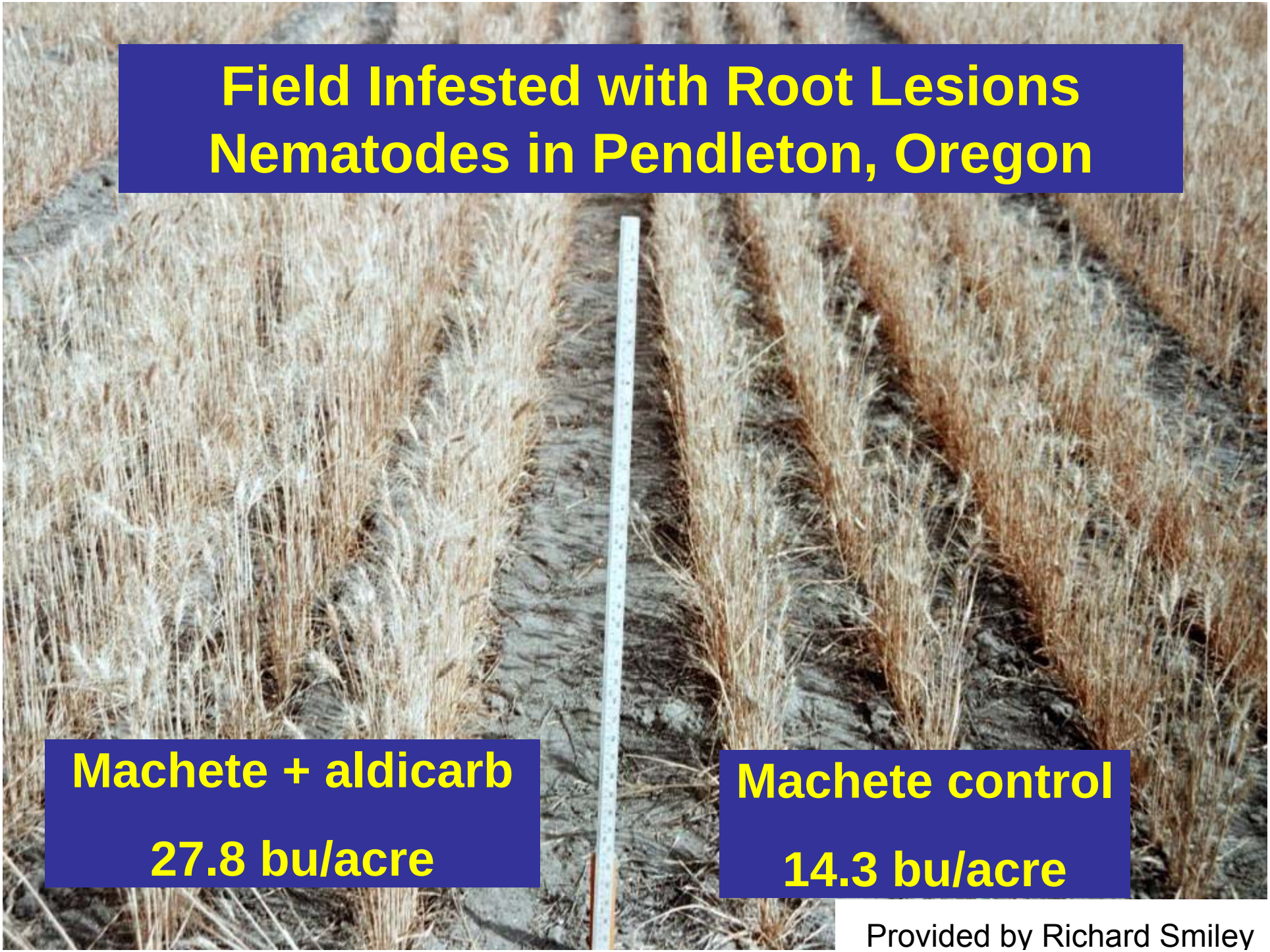
Got to diagnostician…

Something else to consider…

Root Lesions Nematodes

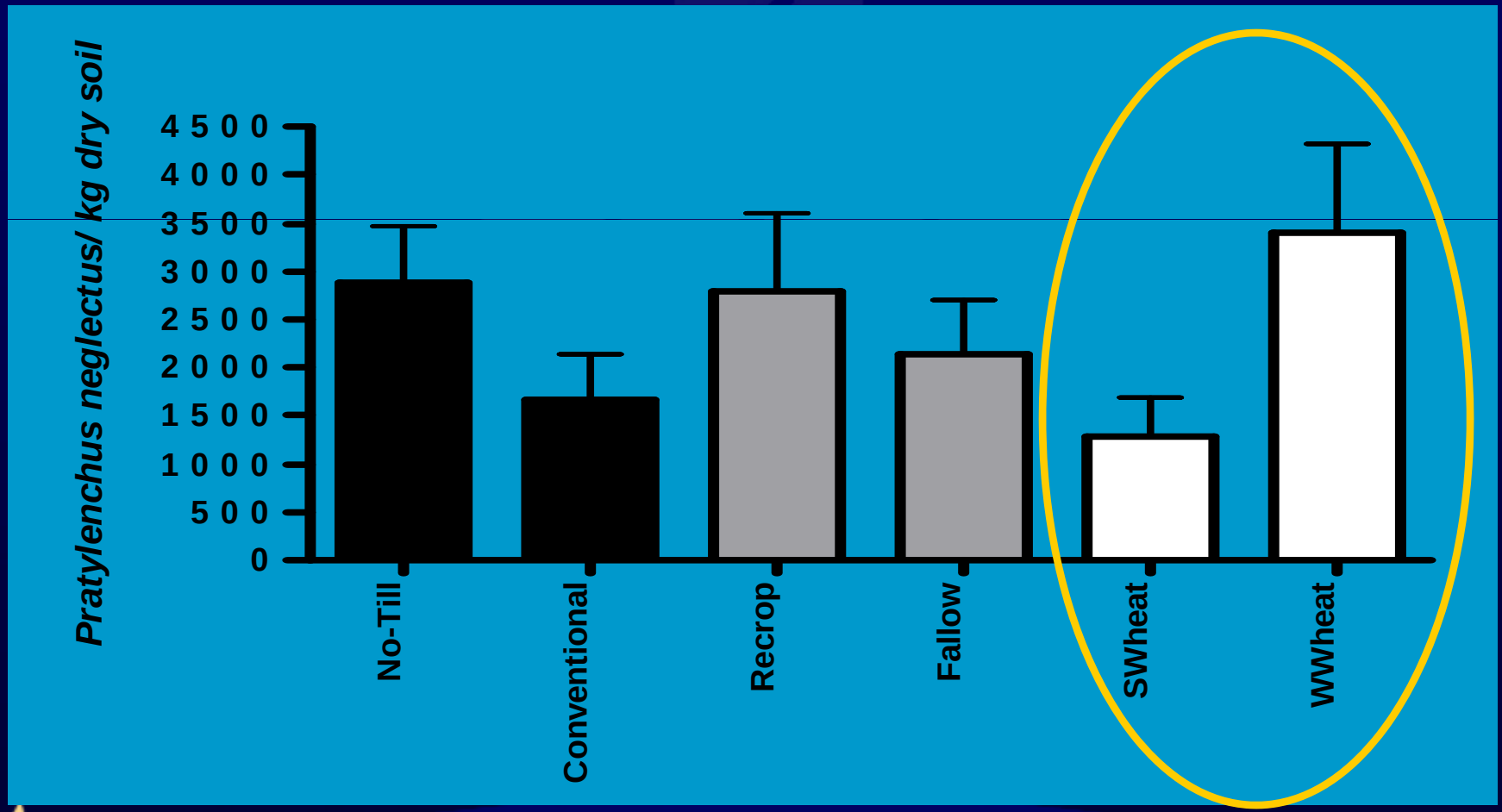
- **Found in Washington, Oregon, Idaho, and Utah…Montana**
- **Endoparasites**
- **Two Species: *Pratylenchus neglectus, Pratylenchus thornei***

Root Lesion Nematodes



Provided by Richard Smiley

Mean populations relative to cropping systems



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Root Lesion Nematodes

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Map http://www.peninsulaflyfishers.org/Fishing_Tales/montanaSpring02/montana_map.gif

Yield Relations

P. neglectus kg dry soil	Low Precip. Winter Wheat*	High Precip. Spring Wheat*
0	16.4	94.3
2000	15.2	87.9
4000	14.0	81.5
6000	12.8	-
8000	11.6	-
10,000	10.4	-

*Yields in bu/ac

Recommendations

- **Rotate to peas or safflower or fallow**
- **Rotate to spring wheat cultivars: Outlook and McNeal**
- **Canola, barley?**
- **Testing:** www.westernlaboratories.com

Questions?